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# NASA-GSFC

Title ~~OPERATIONS PLAN~~
13-63

# TELEVISION OBSERVATIONAL SATELLITE (TIROS H)

OTS PRICE

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Robert G. Sanford et al

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GODDARD SPACE FLIGHT CENTER

GREENBELT, MD.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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NASA - GSFC
OPPLAN 13-63
TIROS H

The purpose of this Operations Plan is to provide planning information for activities concerned and to serve as a guide during the conduct of the operation. Amendments and/or addenda will be issued as necessary.

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NETWORK ENGINEERING AND OPERATIONS DIVISION
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Project Manager

REVIEW SHEET

OPPLAN 13-63
TIROS H

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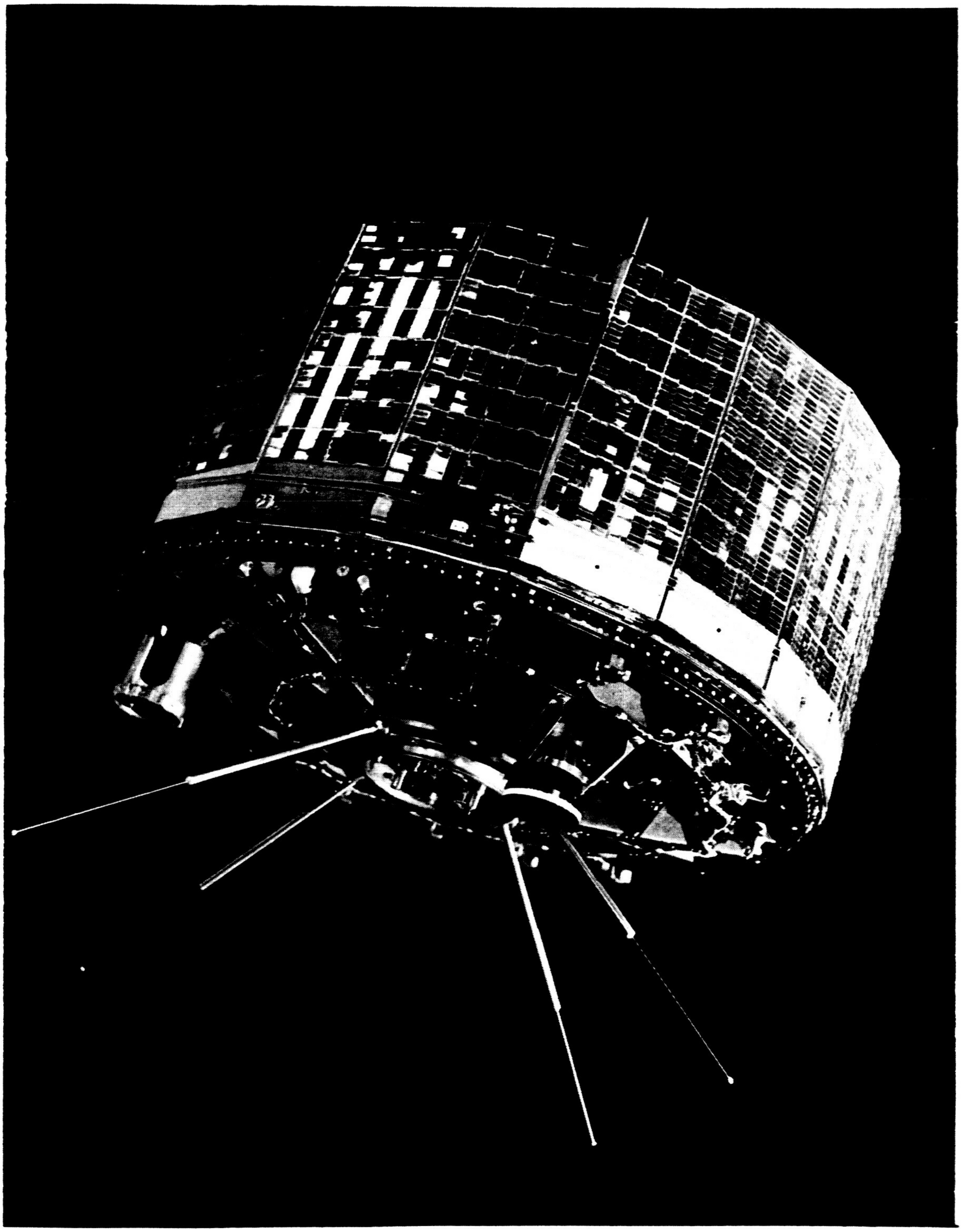
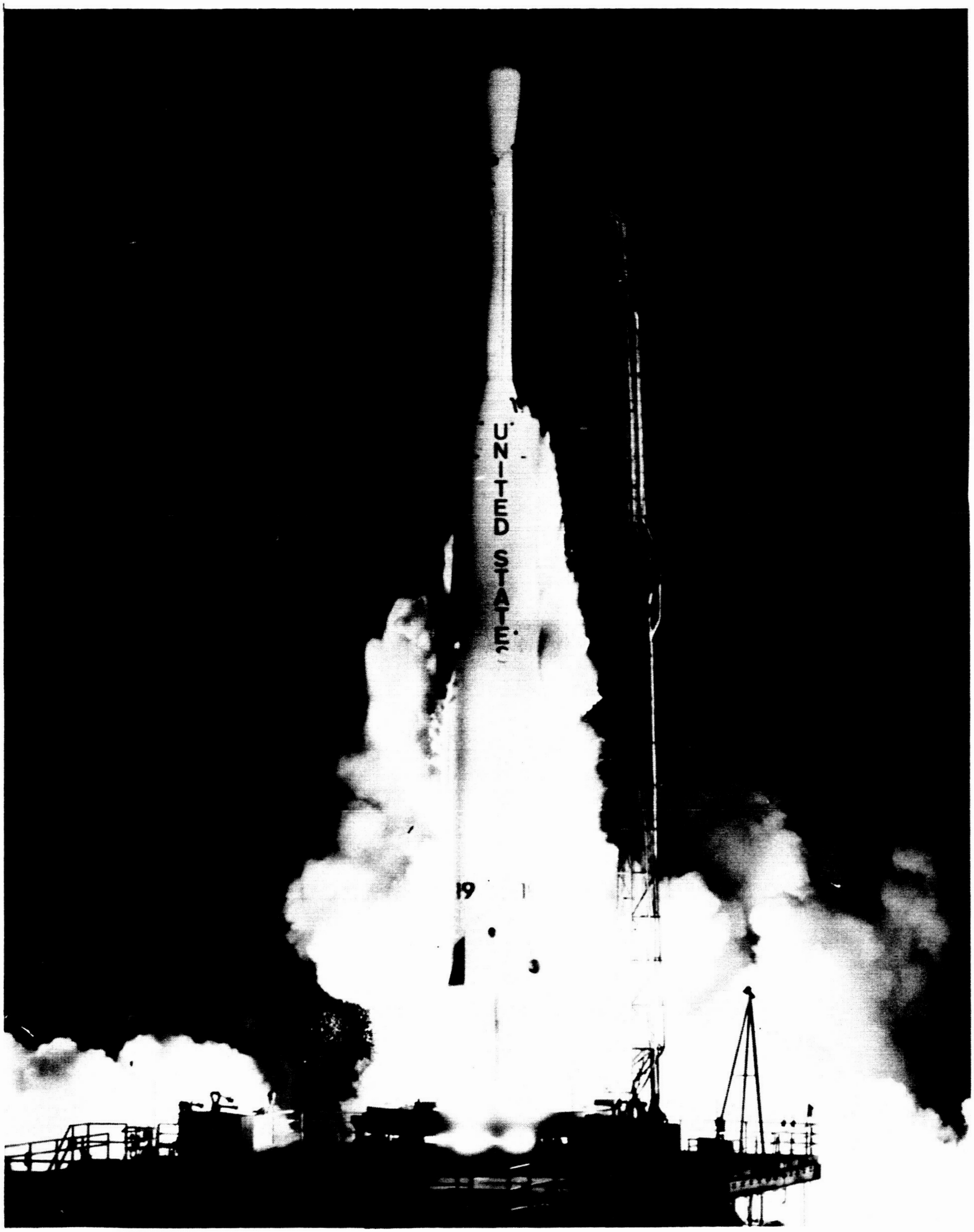


Frontispiece—TIROS Spacecraft




Delta Launch Vehicle

## 1.0 MISSION.

The mission of Project TIROS is to obtain, by means of satellites, meteorological data that will assist scientists throughout the world in their search for a better understanding of the factors that control the world's weather.

## 2.0 RESPONSIBILITIES.

### 2.1 PROJECT MANAGEMENT.

The Aeronomy and Meteorology Division of the Goddard Space Flight Center has the responsibility for the complete Project Management.

### 2.2 VEHICLE.

The Goddard Space Flight Center has the responsibility for the launch vehicle under the NASA Headquarters Office of Space Sciences. The Spacecraft Systems and Project Division of GSFC is responsible to the Project Management for the procurement and modification of the launch vehicle, for providing compatibility between the vehicle and spacecraft and for the launch of the vehicle.

### 2.3 SPACECRAFT.

The Aeronomy and Meteorology Division of the Goddard Space Flight Center has the responsibility for the design, construction, and qualification of the spacecraft. The Radio Corporation of America is under contract to the Project for the fabrication, assembly, and test of the spacecraft.

### 2.4 TRACKING.

The Network Engineering and Operations Division of the Goddard Space Flight Center has the responsibility for the tracking of the spacecraft during the active lifetime of the tracking beacons. The STADAN stations will be utilized for this effort.

### 2.5 DATA ACQUISITION AND COMMAND.

The Data Acquisition and Command stations are located at the NASA Wallops Station, Wallops Island, Virginia; U.S. Naval Missile Center, San Nicolas Island, California. The Data Acquisition Facility at Fairbanks, Alaska, will serve as a Data Acquisition and Command station during the times when this station has been scheduled to operate with the TIROS spacecraft. These stations have the responsibility for the commanding of the spacecraft and for the data acquisition during the useful lifetime of the spacecraft.

The Santiago, Chile, Minitrack Station will transmit the "start clock" command at specified times, but will not provide data acquisition.

2.6 ORBITAL COMPUTATION.

The Data Systems Division of the Goddard Space Flight Center will be responsible for computing the orbit and providing orbital elements, ephemerides, and acquisition predictions.

2.7 ATTITUDE COMPUTATION.

2.7.1 ARACON Geophysics Inc. personnel under contract to the Project are responsible for computing the operational attitude utilizing CDC-160A computers, photo attitude and horizon sensor data.

2.7.2 Definitive.

The Theory and Analysis Office of the Data Systems Division will analyze all available attitude information and provide the definitive attitude and predictive attitude.

2.8 DATA REDUCTION AND ANALYSIS.

Primary TV Data Interpretation will be done at the readout stations by teams composed of Weather Bureau, Air Force and Navy meteorologists. Further processing will be conducted by the National Weather Satellite Center (NWSC), U.S. Weather Bureau, and the Aeronomy and Meteorology Division of GSFC. Gridding of the TV pictures will be accomplished by ARACON Geophysics Inc.

2.9 OPERATIONAL CONTROL.

The TIROS Technical Control Center of the Aeronomy and Meteorology Division of GSFC is responsible for determining the programming of the spacecraft, and for performing the operational control of the Project Mission.

The Network Engineering and Operations Division is responsible for the operational control of the Space Tracking and Data Acquisition Network (STADAN).

## 3.0 PROJECT ORGANIZATION.

### 3.1 PROJECT MANAGER - R. M. Rados.

It is the responsibility of the Project Manager to specify the general project requirements, submit program management plans, insure the flow of information necessary for planning purposes, and insure that the various requirements of the project are implemented in an efficient and expeditious manner.

### 3.2 PROJECT COORDINATOR - E. F. Powers.

It is the responsibility of the Project Coordinator to insure that all phases of the project are directed towards a common goal and to coordinate the activities of the various individuals and organizations who are involved in the Project. He is responsible for supplying the Project Manager with information necessary for planning purposes and for issuing documents and reports needed for the successful completion of the project.

### 3.3 SPACECRAFT SYSTEMS MANAGER - J. Maskasky.

The Spacecraft Systems Manager is responsible for the supervision of the design, fabrication, testing and final checkout of the spacecraft. He supplies the Project Manager with status reports and any other information pertaining to the spacecraft needed for planning purposes.

### 3.4 TRACKING AND DATA SYSTEMS MANAGER - A. D. Rossi.

The Tracking and Data Systems Manager is the senior project representative from the Tracking and Data Systems. He works with the Project personnel to insure that those phases of the Project which are the responsibility of the Tracking and Data Systems are completed in an efficient and expeditious manner. In fulfilling his responsibility, the Tracking and Data Systems Manager will utilize the advice, assistance, and services of various scientists, specialists, and technicians in the Tracking and Data Systems Directorate.

### 3.5 DATA UTILIZATION SYSTEMS MANAGER - H. Oseroff.

The Data Utilization Systems Manager is responsible for assuring the accomplishment of planning, technical, procurement, budgetary, and other actions necessary to design, develop, fabricate, test, and operate the best possible system for utilizing the TV pictures and IR data obtained from the TIROS spacecraft.

3.6 VEHICLE SYSTEMS MANAGER - W. Schindler.

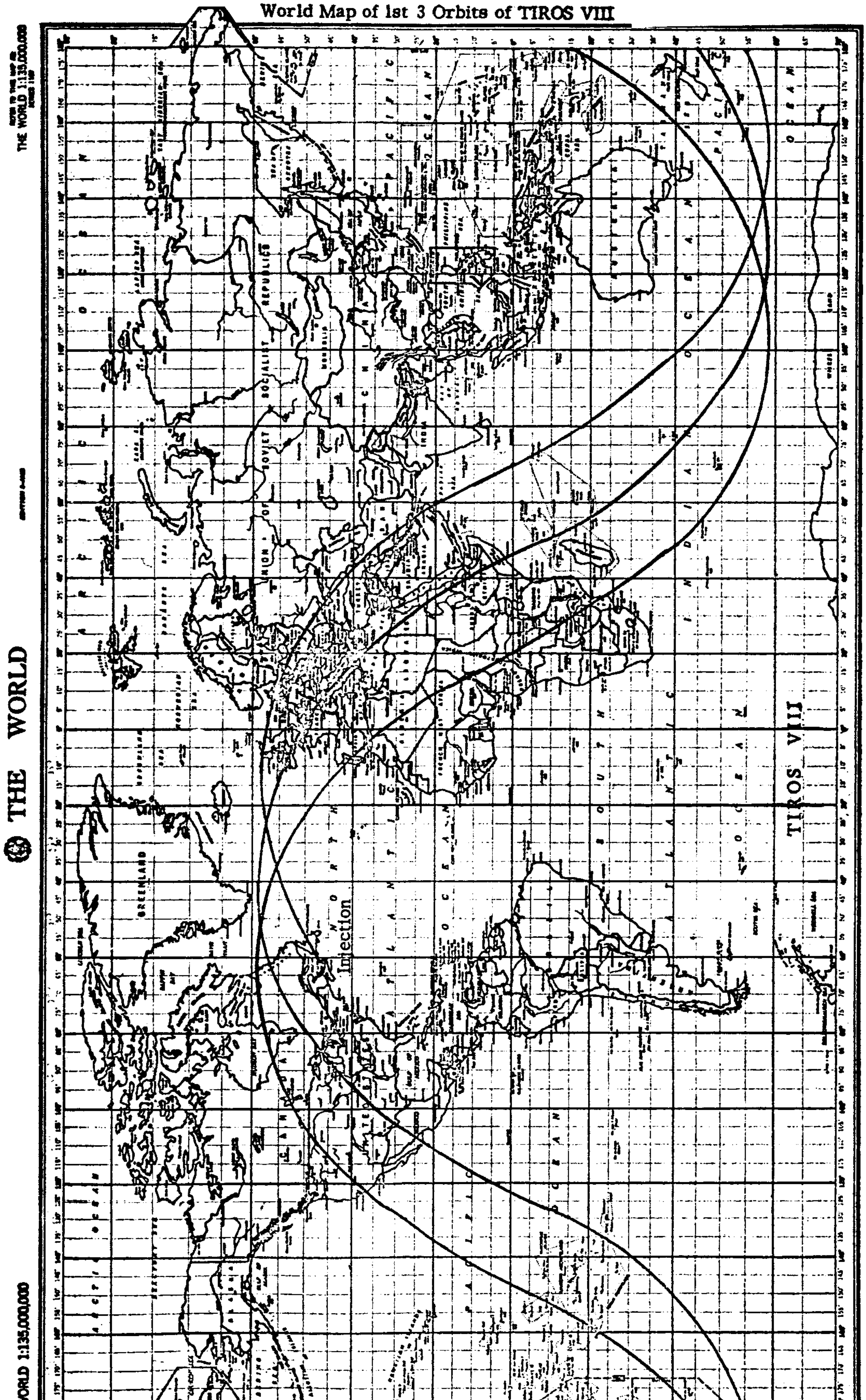
It is the responsibility of the Vehicle Systems Manager to insure that all necessary actions are taken to procure and modify the launch vehicle and to provide compatibility between the spacecraft and launch vehicle. He is also responsible for the launch of the vehicle.

3.7 GROUND OPERATIONS MANAGER - R. G. Sanford.

The Ground Operations Manager (GOM) is a member of the Spaceflight Branch, Network Engineering and Operations (NE&O) Division. During the planning phase, he works closely with the Tracking and Data Systems Manager, to insure that those phases of the project which are the responsibility of the NE&O Division are completed as required and that an adequate and effective ground complex capable of producing the desired results will exist at the proper time.

He is responsible for the preparation of the Operations Plan. During the operational phase, the Ground Operations Manager will be responsible for maintaining direct liaison with the project, maintaining an up-to-date knowledge of the spacecraft status at all times, coordinating project operational requirements with the NE&O Division, and for keeping the Tracking and Data Systems Manager and other appropriate Directorate personnel informed of the project status and ground support activities. He will submit periodic status and operations reports as required.

World Map of 1st 3 Orbits of TIROS VIII



## 4.0 MISSION IMPLEMENTATION.

### 4.1 VEHICLE.

The spacecraft will be placed into orbit by a DELTA three stage vehicle. The first stage is a Douglas Aircraft Thor DM-21, the second stage is an Aerojet General AJ10-118A and the third stage is a Naval Propellant Plant X-248-A5 DM solid propellant motor. The second stage is equipped with the Bell Telephone Laboratory radio guidance system.

### 4.2 ORBIT.

The spacecraft will be placed in a near circular 370 nautical mile orbit with the spin axis-vector initially oriented so as to possess a minimum NADIR angle at 32.5 degrees North latitude. The period of one complete revolution will be approximately 98 minutes. The plane of the orbit will be inclined 58.3 degrees to the plane of the equator.

### 4.3 SPACECRAFT.

The structure is 42 inches in diameter and 19 inches in height. About one fourth of the total 260 pound weight is structural weight. The spacecraft can be considered cylindrical in shape although when viewed from the top it looks like an 18 sided polygon.

The spacecraft structure is composed of two sections: a base plate and a cylindrical cover. The electronics are mounted on the base plate while the solar cells are mounted on both the top and sides of the cover. There are 9,260 solar cells so placed as to intercept the maximum sun energy at any angle of incidence. These solar cells are used to charge 63 nickel-cadmium batteries. The surfaces of the spacecraft are coated to minimize thermal variations caused by sunlight, darkness, and spacecraft orientation with respect to the sun.

The spacecraft package is composed of the following electronic equipment: FM television transmitters, power supply and regulator, beacon transmitters, horizon sensor and associated circuitry, command receivers, clock and control circuitry, telemetry sensors, north indicator and associated circuitry, TV cameras, tape recorders, and magnetic attitude control circuitry. The antenna system consists of four equally spaced transmitting whip antennas extending from the base of the body and forming a crossed dipole.

At separation the satellite will be spinning at 126 ± 12 RPM but, after a 10 minute delay, a timer is activated which will release de-spin weights which are connected by wires that unwrap from the outside surface of the satellite. After the weights have decreased the satellite spin rate to about 10 RPM, they, along with their trailing wires will separate from the vehicle. Precession dampers are provided to eliminate wobble of the vehicle and the magnetic attitude control will control the spin axis. Angular velocity between 9 and 12 RPM can be maintained by firing any pair of 5 pairs of peripheral rockets on command from the stations at San Nicolas Island, California; Wallops Island, Virginia; and Fairbanks, Alaska.

## 4.4 SPACECRAFT SUBSYSTEM.

The TIROS series of satellites are designed to take cloud cover pictures and to measure infra-red radiation of the earth; however, the TIROS H spacecraft is designed to take cloud cover pictures only. Using the standard television method and by an automatic picture transmission method giving pictures in real time, cloud cover over the earth will be monitored.

### 4.4.1 Television.

#### 4.4.1.1 Recording Television Subsystem.

The recording television system consists of a camera, tape recorder, record and playback amplifier, transmitter and control circuitry which make up one subsystem carried in the satellite. The camera is aligned parallel to the spin axis of the satellite which is perpendicular to the base of the structure. When the spin axis is normal to the earth the camera will provide pictures of 725 by 725 nautical mile areas.

The camera is capable of operating in two modes, a storage mode for picture taking over remote areas and a direct readout mode for picture taking within range of the command stations. These modes provide complete flexibility for the programming of picture taking sequences. For the storage mode, a command telemetry ground station (NICOLA, ULASKA or WALACQ) will transmit commands to the satellite causing the camera to take pictures over a prescribed remote area. This involves a programming of the clock associated with the camera. When in the storage mode, 32 pictures (one each 30 seconds) will be stored on the magnetic tape recorder for readout when the satellite passes within range of the programming and receiving station. The storage mode may be by passed by using the direct readout mode if the satellite's spin axis is pointing towards the earth with the camera pointing down when it is within range of the receiving station. The picture information will be transmitted to the ground station on command by a 2 watt FM transmitter at 235.0 Mc.

#### 4.4.1.2 Automatic Picture Transmission (APT) Subsystem.

The APT subsystem is designed to provide wide-angle cloud cover pictures in real time. The equipment employs the same basic principles as the recording television subsystem. No tape recorder is used in the APT subsystem, however, and storage is done in the vidicon by the addition of a polystyrene layer. A timer programs the equipment for cycles of prepare, expose and readout. During readout the vidicon output is amplified and the amplifier output applied to the video detector. Detection produces a continuous analog readout which in turn amplitude modulates a 2400 cps sub-carrier to produce a double sideband-modulated sub-carrier extending across 1600 cycles. The modulated sub-carrier frequency modulates the 136.95 Mc., 5 watt, APT transmission.

4.4.2 Horizon Sensor.

A single infra-red sensor with a 1.3 degree by 1.3 degree field of view is mounted on the rim of the satellite at an angle of 70 degrees to the spin axis. This sensor is used to determine the transition from earth to sky to earth. To accomplish this, the differentiated output of the infra-red sensor is utilized. The differentiated output is amplified and is then used to frequency modulate a 1300 cps sub-carrier which amplitude modulates the 136. 230 Mc. and 136.920 Mc. beacons. The maximum frequency deviation of the 1300 cps sub-carrier is $\pm$ 7 1/2 percent.

The attitude sensor information is continuously being carried by the two beacons except when any of the three ground stations command the satellite to send the environmental telemetry described in 4.4.4 or when the 136.920 Mc. beacon is "off" while the APT system is transmitting.

4.4.3 North Indicator.

The north indicator consists of nine solar cells spaced at 40 degree intervals around the side of the satellite cover. The nine cells are made of three different surface widths and are mounted in a special sequence. For each revolution of the satellite about its axis, nine pulses of three different durations are generated by the solar cells. Using any two successive pulses, the relative duration uniquely determines the angular position with respect to the sun. These pulses are shaped, amplified and fed to the station on a 10 Kc. FM sub-carrier along with the TV signal (235 Mc. carrier). In the storage mode of operation, the signal is fed to channel two of the tape recorders for eventual transmission along with the TV data.

4.4.4 Environmental.

Forty channels of data (temperatures, voltages, etc.) will be sequenced upon command from the three command stations. This information will amplitude modulate a 1300 cps sub-carrier on the two beacon frequencies.

4.4.5 Magnetic Attitude Control.

The Magnetic Attitude Control is used to control the orientation of the satellite. This system will utilize the earth's magnetic field interacting with a coil placed around the payload just about the base plate. Current will be fed to the coil through a 12 position moment control switch which will control the current to allow a variation of the satellite's spin axis from $1^{\circ}$ to $12^{\circ}$ per day in either direction. The switch will use 10 positions to vary the satellite spin axis (five steps in either direction) one position for a calibrating current, and one position for off.

The tone to operate the Magnetic Attitude Control (MAC) switch will be sent to the satellite by the command stations during the time when the satellite is being commanded to operate in the direct mode. A verification signal will be sent by telemetering to show the (MAC) switch position between steps.

4.5 TRACKING.

Tracking operations for the TIROS spacecraft will be the responsibility of the Space Tracking and Data Acquisition Network (STADAN) with the exception of the launch and early orbit period when the spacecraft will be tracked by STADAN, Moorestown Radar, Laredo Radar, SAOCAM, Millstone, and SPASUR. While scientific interest in the spacecraft exists, tracking operations will consist of two phases: the launch and early orbit phase and the normal tracking phase.

4.5.1 Launch and Early Orbit Phase.

During the launch and early orbit phase the stations will attempt to acquire and track the spacecraft using nominal predictions supplied by the Goddard Space Flight Center. As data becomes available these predictions will be revised enabling the stations to acquire additional data which will be used to compute a more definitive orbit.

4.5.2 Normal Tracking Phase.

When the orbit has been established and revised predictions have been prepared, the tracking stations will enter the normal tracking phase. During this phase of the operation the stations will track the TIROS spacecraft utilizing the predictions prepared by the Data Systems Division in accordance with the procedures established by the Space Operations Control Center. The stations will continue to operate in this manner until the tracking beacons cease to transmit.

4.6 COMMAND AND DATA ACQUISITION.

The stations at Wallops Island, Virginia (WALACQ) and San Nicolas Island, California (NICOLA) are Command and Data Acquisition

(CDA) stations. The Data Acquisition Facility (DAF) at Fairbanks, Alaska (ULASKA) will be a CDA station during the times when this station has been scheduled to operate with the TIROS spacecraft. All scheduling of ULASKA is the responsibility of the Network Operations Branch.

For the purpose of acquiring remote picture information which would not be possible to program using only the CDA stations, a special command function is assigned to the Santiago STADAN station. This station will not receive telemetry information.

The TIROS spacecraft will transmit two types of information, realtime and command. The realtime information will be the output of the Horizon Sensor (HI) which is being transmitted at all times on the 136.230 Mc. and 136.920 Mc. carriers except of the short interval during each command period when the housekeeping (40 channels of payload temperature, voltages, etc.) information is sent to the CDA stations on the above carrier. (The 136.920 Mc. beacon will not transmit during the APT transmission times.) The Horizon Sensor information is immediately converted and recorded both on magnetic tape and on Sanborn charts. The forty channels of information are also recorded on both magnetic tape and paper charts.

The commanded information will be acquired and recorded as follows:

4.6.1 Television.

Television data are sent to the CDA stations commanding the satellite by frequency modulating the 235 Mc. carrier. It can consist of data that was taken over a remote area (not within radio range of the station) and stored on magnetic tape within the satellite or direct television data taken while the satellite is within radio range of the station.

At the receiving CDA stations, two television receivers connected in polarization diversity receive the television information. The video subcarrier is isolated by a high-pass filter and fed to the demodulator, sync generator, kinescope deflection circuits, video amplifier and kinescope which displays the video presentation. Each video display is photographed by a 35 mm recording camera. A picture identification code giving the frame number (1 of 32, in binary notation) is photographed along with the received video.

4.6.2 North Indicator.

The north indicator "tone bursts" (short, medium, or long pulse sun angle data) are sent along with the television information. After being received at the station the "sun angle" data is separated from the video information and processed by the sun angle computer for display adjacent to the video information. The separated "sun angle" information is recorded on magnetic tape to provide a record in the event the sun angle computer should malfunction. The computer output is also recorded for permanent record in digital form.

4.6.3 APT TV.

The APT subsystem transmitter is a 136.95 Mc. 5 watt solid state device which transmits the pre-programmed video information to the ground stations.

At the APT receiving stations there is a receiving antenna, pre-amplifier, FM receiver and Facsimile recorder. The APT FM signal is received at the APT ground station by a 13 db gain manually controlled helical antenna system. After amplification by a pre-amplifier at the antenna pedestal the signal is fed to a 136 Mc. FM receiver and the demodulated signal is fed to a Facsimile recorder. The recorder is capable of differentiating ten shades of gray varying from white to black. The APT pictures are produced on an electrolytic paper in an 8 by 8 inch format by the recorder scanning at 240 lines per minute in synchronism with the transmitted picture.

At the key APT stations a tape recorder will be incorporated into the system to enable storage of the data for later use and analysis. The nine key stations for this phase are: Goddard Space Flight Center, Greenbelt, Md. (SFCAPT); RCA at Princeton, N.J. (RCAHNJ); United States Weather Bureau at Suitland, Md. (WEABUR); Fort Monmouth, N.J. (RDLAWA); Fairchild on Long Island (FCHILD); Wallops Island, Va. (WALACQ); Hanscom Field at Bedford, Mass. (AFCRLA); Point Mugu, Calif. (PMRWEA); and Fairbanks, Alaska (ULASKA).

## 5.0 OPERATIONS AND CONTROL.

The operations and control of the Space Tracking and Data Acquisition Network (STADAN) stations utilized in support of TIROS H are the responsibility of the Network Enginnering and Operations Division; operations and control of the TIROS unique stations are the responsibility of the Aeronomy and Meteorology Division. The organization, facilities, and operational procedures which will be utilized in discharging these responsibilities are specified as follows:

### 5.1 LAUNCH AND EARLY ORBIT PHASE.

During the launch and early orbit phase, control of the STADAN will be the responsibility of the Operations Director and will be exercised from the GSFC Space Operations Control Center (SOCC); control of the TIROS unique stations will be the responsibility of the Project Manager and will be exercised by his representative, the TIROS Technical Control Center (TTCC) Manager, out of the TTCC. The following positions have been established to assist the Operations Director during this phase.

Ground Operations Manager (GOM)
Network Controller
Communications Controller
Data Processing Engineer

Additional personnel for SOCC support will be appointed as required by the Operations Director and as dictated by the project requirements.

#### 5.1.1 Countdown Schedule.

A coordinated countdown schedule has been established by the TTCC and the SOCC to insure that all stations participating in the TIROS project are aware of the requirements and that all participating agencies are in the readiness state for the impending launch. In the following countdown D denotes days and T denotes minutes referenced to the nominal launch time.

| COUNTDOWN | ACTION |
|---|---|
| D-10 | TTCC will initiate tests to check the facsimile and voice circuits to the CDA stations.<br><br>TTCC and RCAAED will receive one copy each from WALACQ, RCAHNJ, WEABUR, SFCAPT, RDLAWA, FCHILD and AFCRLA APT ground stations indicating the results of the final checkout using the following: (a) calibration tape, (b) magnetic tape recorder and (c) photo copier. |

TTCC will receive readiness reports from WALACQ, NICOLA, PMRWEA, ULASKA, RCAHNJ and WEABUR.

SOCC will notify STADAN, SAOCAM, SPADATS, SPATRK and SPASUR of the impending launch, giving them the nominal launch date and time and will insure that nominal elements are sent by COMPUT to these agencies.

D-8

TTCC will insure that the GSFC mailroom is ready to handle the mailing at the pre-launch nominal prediction data, and the weekly mailings of the data to the APT ground stations.

TTCC will insure that the Minitrack Section is ready to accept H1 and S-9 data from the spacecraft and provide necessary sample messages for processing through the CDC-160 computer for checkout of the system.

TTCC will insure that the computation and transmission of the simulated (TIROS 7) APT daily messages are being accomplished on schedule and the establishment of means to continuously check the output and receipt of this data at the "key" APT stations.

D-7

SOCC will insure that nominal predictions have been sent by COMPUT to the STADAN and MILLSTONE.

TTCC will insure that nominal World Map and Satellite Acquisition Data (WMSAD) and Attitude World Map predictions are sent by COMPUT to WALACQ, NICOLA, ULASKA, PMRWEA, RCAHNJ and WEABUR. WMSAD data is to be transmitted by TTY and the Attitude World Map by mail.

TTCC will insure that nominal WMSAD predictions are transmitted to SNTAGO and CAPCAN and that Attitude World Map predictions are sent to RDLAWA, FCHILD, SFCAPT and AFCRLA.

TTCC will insure that Trajectory predictions are available to WALACQ, CAPCAN and RCAHNJ.

SOCC will insure that trajectory predictions have been sent by COMPUT to MOORESTOWN, MILLSTONE, NEWFLD, BLOSSOM POINT and BERMUDA.

TTCC will insure that copies of the APT evaluation log format have been received at the WALACQ, PMRWEA, ULASKA, RACHNJ, FCHILD, SFCAPT, RDLAWA, WEABUR and AFCRLA APT stations and that copies of the log format have been mailed to all of the APT ground stations.

| COUNTDOWN | ACTION |
|---|---|
| D-6 | TTCC will initiate tests to check out the teletype circuits to RDLAWA, FCHILD and AFCRLA at 1500Z. |
| | TTCC will receive a sample APT Pass Summary and Evaluation Report at 1700Z from WALACQ, RCAHNJ, PMRWEA, ULASKA, WEABUR, RDLAWA, FCHILD and AFCRLA. |
| | TTCC will send out the nominal daily predictive message for TIROS H to the "key" APT stations including the CDA stations. |
| D-5 | TTCC will initiate tests to check the facsimile and voice circuit to Hanger "AE". |
| D-4 | TTCC will verify that all nominal orbital and attitude predictive data has been received and are available at the CDA and other key APT stations. |
| D-3 | SOCC will obtain nominal doppler from the Cape Satellite Tracking Station. |
| | TTCC will receive a 1700Z report from the selected APT stations as in D-6. |
| D-1 | SOCC will send communications condition GREEN and alert all stations to be prepared to implement the TIROS OPPLAN 13-63. |
| | SOCC will alert the Chief Operator at GSFC telephone switchboard of impending operations. |
| | TTCC will send a launch-alert message to all TIROS unique stations. |
| T-480 to T-170 | SOCC will relay status reports to the Project Manager in Hanger "AE" which have been received from STADAN, MOORESTOWN, WALACQ, NICOLA, ULASKA and RCAHNJ. |
| T-150 | SOCC will set condition RED to the selective participating stations and impose MINIMIZE. |
| T-120 | SOCC will forward a request for and receive station readiness reports from all participating stations. |
| | Same as T-480 to T-170. |
| T-60 | SOCC will request and receive station readiness reports from all participating stations. Establish phone circuits between SOCC Number "C" and GSFC/FPB Satellite Tracking Station (Cape Number "A") Cape Liaison Officer. Forward information concerning spacecraft and vehicle status received from the Cape to the participating stations. |

T-40 SOCC will establish the following phone circuits (5.1.2)

SOCC Number "A" to Cape Number "B"
SOCC Number "B" to Cape Number "C"

T-30 to T-0 SOCC will establish all remaining phone circuits. Receive spacecraft beacon frequencies from Cape Liaison Officer via phone and forward to all stations. Receive all pertinent pre-launch information by phone and/or TTY and relay to all stations concerned.

LIFT-OFF SOCC will receive lift-off by phone from Cape Liaison Officer and forward to GSFC Space Communications Center for immediate relay to all stations.

5.1.2 Telephone Communications.

Telephone communications for liaison, coordination and/or data collection will be established as outlined below.

5.1.2.1 SOCC to GSFC/FPB Satellite Tracking Station - Cape Liaison Officer. (SOCC Number "C" to Cape Number "A"). This circuit will be the initial contact with the Cape and will be used to keep SOCC fully informed of the status of the launch operations. The information received over this phone will include vehicle and payload status, countdown, accurate lift-off time, vehicle staging and other information pertinent to the operations.

5.1.2.2 SOCC to GSFC/FPB Satellite Tracking Station (SOCC Data phone to Cape data phone).

This data phone will be used to receive Doppler data on a real time basis. This phone can be used for either voice communication or data transmission. Initial contact between the SOCC and the Cape will be made by voice. The circuit will then be switched to a mode for data transmission.

5.1.2.3 SOCC to GSFC/FPB Satellite Tracking Station - Cape Doppler Officer (SOCC Number "A" to Cape Number "B").

This phone will be used to receive Doppler data to be passed to NASA Headquarters and to serve as a backup to the data phone and to the initial phone contact with the Cape.

5.1.2.4 SOCC to GSFC Mission Control Center - Project Liaison Officer (SOCC Number "B" to Cape Number "C").

This circuit will be activated to allow the Project Liaison Officer to send information to the Project Manager and to receive information from the Cape with regard to reasons for holds, etc.

5.1.2.5 SOCC to BTL Guidance Facility - Computer Liaison Office (SOCC Number "I" to Cape Number "D").

This circuit will be activated at lift-off and will be used to receive position and velocity vectors at SECO as computed by the BTL Guidance Facility.

5.1.2.6 SOCC to NASA Headquarters Mission Status Room - Technical Liaison Officer (SOCC Number "G" to NASA Headquarters Number "A").

This phone will be used to keep the NASA Headquarters Mission Status Room fully informed of the progress and status of the launch operations at all times. This information will be received in the Mission Status Room by the Tracking and Data Acquisition Liaison Officer.

5.1.2.7 SOCC to NASA Headquarters Press Room - Public Information Officer (SOCC Number "H" to NASA Headquarters Number "B").

The NASA Headquarters Press Room will be kept fully informed of the status and progress of the launch operation at all times via this phone.

5.1.2.8 SOCC to Moorestown Tracking Station - Station Liaison Officer (SOCC Number "E" to Moorestown Number "A").

This circuit will be used to receive vehicle tracking data as received by the Moorestown Radar Tracking Facility.

5.1.2.9 SOCC to WNKFLD STADAN station - Station Liaison Officer (SOCC Number "K" to Winkfield, England Number ROW 448).

This line will be activated so that the very important third stage payload separation information can be received on a real-time basis and relayed to the Project Manager.

5.1.3 Launch Data.

Launch Data in the form of doppler, vehicle trajectory and orbit information, and station acquisition and loss information will be given to the appropriate personnel in the SOCC and will be entered on the display facilities.

5.1.4 Interferometer Data.

During this phase, TIROS H will receive first tracking priority at the STADAN stations. The interferometer tracking data will be received on teletype tape by the Minitrack Section and will then undergo editing, ambiguity resolution, and conversion to direction cosine data by the CDC-160A computer. The direction cosine data will then be printed out on paper and punched out on BCD observation cards to be used by the Early Orbit Determination Group for orbital computation. A copy of the reduced interferometer data will be sent to SAOCAM, SPADATS, SPASUR and SPATRK for use in their orbital computations.

5.1.5 Moorestown Radar Data.

The Moorestown Radar data will be received by phone in the Early Orbit Determination Room and will be converted to the azimuth-elevation-range format.

5.1.6 Millstone Radar.

The Millstone Radar data will be addressed to COMPUT and received by TTY and converted to the azimuth-elevation-range format.

5.1.7 Miscellaneous Data.

All tracking data, not already described, will be sent to the Early Orbit Determination Room for orbital computations.

5.1.8 Space Operations Control Center Displays.

The Control Center Branch and the Network Operations Branch will be responsible for the operation of the SOCC displays. Displays will be required for showing the countdown, vehicle and spacecraft status, terminal count, station acquisition information, station status, launch and orbital parameter Gamma vs. V/VR, doppler and other information of interest.

5.1.9 Network Operations Branch

During the launch and early orbit phases the Network Control Section of the Network Operations Branch will be responsible for the following:

5.1.9.1 Insuring that sufficient STADAN tracking data are obtained for the computation of the orbit at the earliest practical time.

5.1.9.2 Operating the SOCC displays in conjunction with the Control Center Branch.

5.1.9.3 Working with the GOM and the TTCC to ensure a smooth flow of information to and from the ULASKA Data Acquisition Facility.

5.1.9.4 Providing the Ground Operations Manager with periodic reports concerning the STADAN activities. Unusual activities will be reported in near real-time and a summary STADAN activity report will be prepared daily at 0600 local time for three consecutive days after launch.

5.1.10 Spaceflight Branch.

The Ground Operations Manager from the Spaceflight Branch will be responsible for the following:

5.1.10.1 Providing the Operations Director with a recommended pre-launch organization chart showing position assignments by name.

5.1.10.2 Submitting an access list to the Operations Director for inclusion in the complete SOCC access listing.

5.1.10.3 Verifying that the Operations Plan and station predictions have been distributed to those concerned and that all ground support elements are aware of their assigned responsibilities.

5.1.10.4 Coordinating data acquisition requirements between the TTCC and NETCON.

5.1.10.5 Coordinating pre-launch arrangements with the GSFC and outside agency telephone representatives to insure prompt placement of long distance telephone calls and uninterrupted service.

5.1.10.6 Providing the Operations Director with progress information as needed.

5.1.10.7 Preparing Morning Progress Reports with all available information for three consecutive days after launch for distribution at 0800 local time each day.

5.1.11 TIROS Technical Control Center.

The TTCC is responsible for ensuring that the TIROS unique stations have all the information necessary to support the launch and by working through the Ground Operations Manager to ensure that SNTAGO and ULASKA have their information.

In addition, the TTCC is responsible for conducting pre-launch rehearsals, preparing all graphs and logs to accept spacecraft information after orbit is obtained and preparing programs to be used if the spacecraft orbit is attained.

5.2 NORMAL PHASE.

Unless unforeseen complications develop the Normal Phase will begin as soon as the spacecraft orbit has been determined and updated predictions have been computed and forwarded to the STADAN and Command and Data Acquisition (CDA) stations.

5.2.1 Spaceflight Branch.

During this phase, the Ground Operations Manager will be responsible for maintaining liaison with the Project, maintaining an up-to-date knowledge of the spacecraft status at all times, coordinating Project requirements between the Project and NETCON and for keeping the appropriate Directorate personnel informed of the Project status and ground support activities. He will submit periodic status and operations reports as required. This will include, but is not limited to, the Weekly Progress Reports which are submitted to the T&DS Manager.

5.2.2 Network Operations Branch.

During the Normal Phase the Network Control Section of the Network Operations Branch will be responsible for the following:

5.2.2.1 Scheduling and monitoring the operations of the GSFC Space Tracking and Data Acquisition Network stations.

5.2.2.2 Providing the GOM with the information needed for the Morning Progress Reports. Weekly ULASKA reports submitted by the ULASKA Station Manager are to be prepared in duplicate for the GOM.

5.2.2.3 Ensuring that the ULASKA and SNTAGO stations provide TIROS project support in accordance with established priority procedures. Direct liaison with the TTCC should be effected for normal operations with the GOM being informed of any deviations from the normal.

5.2.3 TIROS Technical Control Center.

The duties and responsibilities of the TTCC are imposed by the Aeronomy and Meteorology Division. The TTCC will work through the Ground Operations Manager on all requirements involving the use of the STADAN facilities.

## 6.0 FIELD STATION OPERATIONS.

### 6.1 TRACKING.

Tracking responsibilities for the TIROS satellite will be broken into two phases: Launch and Early Orbit Phase and the Normal Tracking Phase. Cooperating agencies along with STADAN will have tracking assignments during the Launch and Early Orbit Phase, but only the STADAN stations will be responsible for the Normal Tracking.

#### 6.1.1 Launch and Early Orbit Phase.

##### 6.1.1.1 Bermuda Radar.

The Bermuda Radar Facility shall track the TIROS H first and second stage and forward information to GSFC by high speed data link for trajectory computations.

##### 6.1.1.2 GSFC/FPB Satellite Tracking Station.

This Station shall track the spacecraft signals from lift-off until the signal is lost. Frequency versus time data shall be relayed to the SOCC via the data phone on a real time basis. The Satellite Tracking Station shall also relay to the SOCC via telephone and/or teletype, as feasible, all pertinent data and information (i.e. countdown, accurate time of lift-off, ignition and burnout of the various stages, general status and progress of the operation, etc.).

##### 6.1.1.3 Fort Myers STADAN Station.

Fort Myers shall attempt to monitor the tracking transmitter from launch until the signal is lost. Notify SOCC when the signal is acquired and lost.

##### 6.1.1.4 Blossom Point STADAN Station.

The Blossom Point STADAN station shall monitor the TIROS signal approximately 140 seconds after lift-off and will send a message to SOCC when the signal is acquired and lost.

##### 6.1.1.5 Winkfield STADAN Station.

The Winkfield Station shall monitor for the TIROS signal approximately 22 minutes after lift-off and will send a message to the SOCC when the signal is acquired and lost.

6.1.1.6 Goldstone STADAN Station.

MOJAVE shall monitor for signal nominally one hour and 20 minutes after launch using the Yagi antenna pointed south at an elevation of 15 degrees. Send a message to SOCC when the signal is acquired and lost.

6.1.1.7 NORAD Space Detection and Tracking Systems.

The NORAD Space Detection and Tracking Systems facilities requested to participate in the TIROS H mission are as follows:

U. S. Naval Space Surveillance Systems
Laredo, Texas
Moorestown, New Jersey

6.1.1.7.1 U. S. Naval Space Surveillance Systems.

U. S. Naval Space Surveillance System is requested to track the satellite for the first 24 hours after launch and forward tracking data, via telephone and/or teletype, to the GSFC "COMPUT" as soon as possible.

6.1.1.7.2 Laredo Tracking Facility.

The Laredo Tracking Facility is requested to track the satellite on the first pass after launch and supply tracking data in the form of azimuth, elevation and slant range by teletype to GSFC "COMPUT" as soon as possible after signal loss.

6.1.1.7.3 Moorestown Tracking Facility.

The Moorestown Tracking Facility is requested to track the satellite during the launch, first and second orbit, and supply tracking data in the form of azimuth elevation and slant range, to GSFC by telephone and/or teletype as soon as possible after signal loss.

6.1.1.8 Smithsonian Astrophysical Observatory (SAOCAM).

The SAOCAM is requested to optically track the spacecraft during the first 24 hours after the launch and to supply tracking data, via teletype to GSFC "COMPUT" as soon as possible after it is obtained.

The tape from the NEWFLD station should be mailed as soon as possible after second stage telemetry is recorded to the following address:

Goddard Space Flight Center (NASA)
Attn: Code 537
Network Operations Branch
Greenbelt, Maryland
U.S.A.

The Wallops Island tape should be mailed to the following address:

Mr. D. Sheppard
GSFC Field Projects Branch
Atlantic Missile Range
Port Canaveral, Florida

6.2.2 First Pass Telemetry.

The normal 1300 cps sub-carrier which is amplitude modulating the 136.920 Mc beacon with Horizon Sensor information will be biased to 1400 cps from launch until separation of the payload from the third stage. At separation the bias is removed and the sub-carrier frequency returns to 1300 cps. The 136.230 Mc beacon will be amplitude modulated by a 1300 cps sub-carrier at all times. The separation will occur nominally 21.5 minutes after lift-off.

The sub-carriers on both beacons are frequency modulated with a maximum deviation of $\pm$ 7½% by the signals from the Horizon Scanner Sensor. Nominally ten minutes after separation de-spin occurs at which time the satellite should attain a spin rate of about one complete cycle every six seconds. Since the Horizon Sensor discriminated signal has the form shown below, the spin rate can be determined by measuring the frequency of the modulation. Before de-spin the satellite will be spinning at approximately 126 RPM. Suggested methods of determining the sub-carrier frequency on the 136.920 Mc beacon and the spin rate at the two STADAN stations involved in the launch telemetry phase are given below.


The spin rate can easily be determined by subtracting the time of pulse two from the time of pulse one to get the time for one complete revolution and then by dividing 60 by the time of one revolution, the spin rate is known.

6.1.1.9 Millstone Tracking Facility.

The Millstone Tracking Facility is requested to track the satellite during the launch, first and second orbits and supply data in the form of azimuth elevation and slant range to GSFC by TTY as soon as possible after signal loss.

6.1.2 Normal Tracking Phase.

The Normal Tracking Phase will begin upon notification from SOCC.

6.1.2.1 Predictions.

Until the computing center issues revised predictions as data becomes available, SOCC will send predictions in the form of estimated time of latitude and meridian crossing and direction of the spacecraft with respect to the station. The estimated predictions will not be sent if it is seen that the actual orbit is very near the nominal orbit.

6.1.2.2 Tracking.

All stations in the world-wide STADAN will be responsible for tracking TIROS during this phase. Tracking will be in accordance with station capability and will be scheduled by NETCON.

6.1.2.3 Tracking Beacons.

The TIROS Satellite will have two tracking beacons for redundancy purposes. The STADAN stations are to track the 136.230 Mc. beacon. In case the 136.230 Mc. beacon should fail, SOCC should be informed on an urgent basis so instructions can be sent to the stations notifying them that the tracking should then be accomplished using the 136.920 Mc. beacon.

6.2 TELEMETRY.

The CDA stations at Wallops Station, Virginia; San Nicolas Island, California and Fairbanks, Alaska have the complete responsibility for receiving the TIROS telemetry except for the first pass of the satellite after launch over the BPOINT, WNKFLD and NEWFLD STADAN stations.

6.2.1 Second Stage Telemetry.

The Newfoundland (NEWFLD) STADAN station and the CDA Wallops Station shall record second stage telemetry. A 234.00 Mc. beacon will be used for this purpose.

6.2.2.1 Blossom Point, Maryland.

The Blossom Point station will be responsible for determining the third stage spin-rate at spin-up (approximately 647 seconds after launch) and forwarding the spin-rate information to SOCC as soon as it has been determined. Procedures for determining the spin-rate are outlined in 6.2.2.2.

6.2.2.2 Winkfield, England.

The Winkfield, England STADAN station will be responsible for determining separation and de-spin. The AM detected output of the MOD I Telemetry receiver tuned to 136.920 will be fed to the tuneable discriminator tuned to a center frequency of 1350 cps with a $\pm$ 15% deviation. The output of the discriminator is to be displayed in real-time on a Sanborn recorder. The spin-rate can be determined by observing the frequency of the Horizon sensor square wave signal (see 6.2.2). Separation can be determined by observing the center frequency of the sub-carrier being recorded. If the center frequency is closer to the 1500 cps side of the record separation did not occur. If it is closer to the 1200 cps side of the record then the 1300 cps is monitoring the carrier and separation did occur. The spin-rate and separation information are to be forwarded to the SOCC as soon as they are determined. Two copies of the spin-rate and separation Sanborn recordings with appropriate identification and legend are to be forwarded to NETCON by mail.

6.2.3 Normal Telemetry.

The CDA stations (WALACQ, NICOLA and ULASKA) will be the only stations receiving telemetry data from the TIROS Satellite. These three stations and the Santiago STADAN station are the only stations authorized to interrogate the satellite.

The spacecraft will be interrogated only upon receipt of specific programming instructions from the TTCC.

## 7.0 SPACE COMMUNICATIONS CENTER OPERATIONS.

### 7.1 LAUNCH AND EARLY ORBIT PHASE.

During the launch and early orbit phase, the GSFC Space Communications Center and all participating stations will be fully activated for communication launch operations as required. Communication procedures will be in accordance with TCFP-1. Communication links will be required to all participating stations as indicated in this Operations Plan.

#### 7.1.1 Teletype Operations.

##### 7.1.1.1 Communication Status.

For the purpose of this Operations Plan, the following status conditions will apply for the participating stations in the network.

7.1.1.1.1 Condition BLUE. Normal routine status, any launch operations over 24 hours in the future.

7.1.1.1.2 Condition GREEN. Launch operations expected within 24 hours in the future.

7.1.1.1.3 Condition RED. Launch operations in progress. Countdown is proceeding on schedule and is within two and one half hours of lift-off. MINIMIZE (transmit only operational traffic pertaining to the launch, unless otherwise authorized or directed by the control station) will be imposed. If lengthy delays occur, the network may be returned to condition GREEN or BLUE, depending upon the expected length of the delay.

#### 7.1.2 Station Grouping.

Certain tracking stations will be grouped into launch operation network groups. Normally two groups will be established, group I will consist of NETCON, SPACON, applicable Launch Operations Center, and initial tracking station plus any others required or designated by the Ground Operations Manager. Group II will consist of NETCON, SPACON, and other tracking and data acquisition stations as required.

Typical Station Groupings for the TIROS H launch will be as follows:

| GROUP I | GROUP II |
| --- | --- |
| NETCON | NETCON |
| CAPCAN | NEWFLD |

| GROUP I | GROUP II |
|---|---|
| FTMYRS | WNKFLD |
| BPOINT | PMRWEA-NICOLA |
| RCAHNJ | ULASKA |
| SPACON | SPACON |
| ICONO | WALACQ |

7.1.2.1 Pre-launch Communication Checkout for Grouped Stations.

Stations shown in para 7.1.2 will be grouped 30 minutes prior to release of control to NETCON in order to allow time for thorough circuit grouping and communication checkout.

7.1.3 Communications Countdown.

This countdown is referenced to the nominal lift-off time and contains only those periods in the countdown which require action by personnel in the Space Communications Center. D denotes days and T denotes minutes referenced to lift-off.

| ITEM | TIME | NETWORK COMMUNICATIONS CONDITION | ACTION | RESPONSIBILITY |
|---|---|---|---|---|
| I | D-7 | BLUE | Conduct Communication exercise. | SPACON |
| II | D-5 | BLUE | Alert sub-switching centers and common carriers concerned and will apprise them of: (1) the period close circuit observation is desired, (2) the circuits critical to the launch operation, and (3) such other needed information that may be unique to the specific launch operation. | FACCON |
| III | D-1 | GREEN | Verify special coverage notice to carriers as outlined in item IV. | FACCON |
| IV | T-120 | RED | Establish Network Groups and conduct complete system test with all participating stations. This test must be received perfectly by SPACON otherwise stations will not be considered ready. | SPACON |

| ITEM | TIME | NETWORK COMMUNICATIONS CONDITION | ACTION | RESPONSIBILITY |
|---|---|---|---|---|
| V | T-30 | RED | Terminate transmissions on all circuits except the continuing count from CAPCAN. | ALSTA |
| VI | LIFT-OFF | RED | LIFT-OFF. NETCON keeps GROUP I & II informed of all progress, SPACON informs all others. | SPACON/ NETCON |
| VII | T + 15 | RED | Control of GROUP I & II reverts to SPACON who will adjust or terminate special launch groupings and conditions as needed. | NETCON/ SPACON |

7.1.4 Data Transmission.

During the launch and early orbit phase, all tracking data received in the Space Communications Center will be forwarded to the Early Orbit Determination Group and the Minitrack Data Section on a real-time, or near-real time basis, as required.

7.2 NORMAL PHASE.

All stations will revert to standard operating procedures at the termination of the launch and early orbit phase.

7.3 SWITCHING CONFERENCING AND MONITORING ARRANGEMENT (SCAMA).

7.3.1 Facsimile/Voice Communications.

7.3.1.1 General.

Four complete Facsimile and Voice Communication loops will be established in the SCAMA Network as follows:

7.3.1.1.1 TTCC, Weather Bureau and Wallops Island.

7.3.1.1.2 TTCC, Weather Bureau and San Nicolas Island

7.3.1.1.3 TTCC, Weather Bureau and ULASKA

7.3.1.1.4 TTCC, Weather Bureau and RCAHNJ

The GSFC SCAMA will be the central control point for these circuits and will have the capability for connecting the four loops so that the stations can contact each other. While photographs are being transmitted over the Facsimile circuit, voice cannot be transmitted in the same direction as the Facsimile transmission, but voice can be transmitted in the opposite direction.

7.3.1.2 Special.

One complete Facsimile and Voice Communication loop will be established as follows:

SOCC (TTCC) and Cape Hangar "AE"

This loop will be established approximately 5 days prior to launch and will be in existence for approximately one week. While photographs are being transmitted over the Facsimile circuit, voice cannot be transmitted in the same direction as the Facsimile transmission, but voice can be transmitted in the opposite direction.

7.3.2 Voice/Data Communications.

Voice/data lines will be established in the SCAMA network between NICOLA, WALLOPS, ULASKA, RCAHNJ, WEABUR and GSFC. The GSFC comput will also be connected to the SCAMA network. Data will be sent by a 1200 bit/sec digitronics system over these lines between GSFC, NICOLA, WALACQ and ULASKA stations. Since data transmission will utilize these lines for relatively short periods, these lines will be the primary voice links between the NICOLA, WALACQ and ULASKA stations and GSFC (TTCC).

An additional temporary SCAMA line will be established between GSFC and Hangar "AE".

## 8.0 COMPUTER CENTER OPERATIONS

The Data Systems Division will coordinate and provide the computer operations for the TIROS project.

### 8.1 PRE-LAUNCH OPERATIONS.

The following items are to be accomplished by elements of the Data Systems Division. (All times are referenced in days from the nominal launch day.)

| Countdown | Action | Responsibility |
|---|---|---|
| D-30 | Tracking facilities required for TIROS support are to be coordinated with the Network Engineering and Operations Division. | Theory and Analysis Office |
| D-30 | Orbital elements are determined for the initial nominal launch conditions. | Theory and Analysis Office |
| D-20 | Computation of the APT daily messages will commence. | Theory and Analysis Office |
| D-20 | Teletype transmission of the APT daily messages will commence. | Minitrack Section |
| D-20 | Computation of the APT weekly messages will commence. The weekly messages will cover a two week period computed one week in advance. | Theory and Analysis Office |
| D-20 | Preparations for mailing the APT weekly messages will commence. | Computer Services Section |
| D-10 | Pre-launch attitude reports are presented to the TIROS Project Office. | Theory and Analysis Office |
| D-7 | Nominal World Map and Station Acquisition Data (WMSAD) is prepared for distribution. | Theory and Analysis Office |
| D-7 | Nominal WMSAD predictions are computed for WALACQ, NICOLA, ULASKA, SNTAGO, RCAHNJ, CAPCAN, BEMUDA, MILSTN, NEWFLD, WNKFLD, and IMOORE. | Theory and Analysis Office |

| Countdown | Action | Responsibility |
|---|---|---|
| D-7 | Nominal WMSAD predictions for the APT stations; AFCRLA, FCHILD, RDLAWA, SFCAPT and WEABUR; are computed. | Theory and Analysis Office |
| D-7 | Nominal World Map (WMAP) and station predictions are computed for the STADAN, SPASUR stations, Smithsonian Astrophysical Observatory stations, Moorestown, Millstone and Laredo. | Orbit Determination Group |
| D-7 | Nominal topocentric predictions are prepared for ULASKA. | Orbit Determination Group |
| D-7 | Nominal predictions are sent to the stations. | Minitrack Section |
| D-7 | The schedule of nominal minitrack, radar and optical tracking is prepared showing expected acquisition. | Minitrack Section |
| D-7 | Nominal WMAP and station predictions are prepared for distribution. | Computer Services Section |
| D-7 | The nominal trajectory predictions as given in the Detailed Test Objectives (DTO) are prepared for transmission to BPOINT, NEWFLD, BEMUDA, MILSTN, and IMOORE. | Minitrack Section |

Predictions are to be transmitted as given below. The listed stations are to receive nominal predictions for the first three orbits unless otherwise noted.

| Station | Orbital Elements | Equator Crossings | Axes Crossings | Predicted Observatory | Vehicle Trajectory |
|---|---|---|---|---|---|
| Blossom Point, Md. | x | x | x | | x |
| Ft. Myers, Fla. | x | x | x | | |
| Goldstone, Calif. | x | x | x | | |
| E. Grand Forks, Minn. | x | x | x | | |
| College, Alaska | x | x | x | | |
| St. Johns, Newfoundland | x | x | x | x* | x |
| Winkfield, England | x | x | x | x* | |
| Woomera, Australia | x | x | x | | |
| Santiago, Chile | x | x | x | | |
| Lima, Peru | x | x | x | | |
| Quito, Ecuador | x | x | x | | |
| Hartebeestock, S. Africa | x | x | x | | |

* indicates that predictions are needed for orbit zero (0) only.

| Station | Orbital Elements | Equator Crossings | Axis Crossings | Predicted Observatory | Vehicle Trajectory |
|---|---|---|---|---|---|
| SAOCAM | x | x | | | |
| SPADATS | x | x | | | |
| SPASUR | x | x | | | |
| SPATRK | x | x | | | |
| Bermuda | | | | | x |
| Millstone | | | | x | x |
| Moorestown | | | | | x |

NOTE: The Alaska DAF Station, ULASKA, requires topocentric predictions. Wallops Island and San Nicolas Island receive predictions derived from the WMSAD.

A bound copy of the nominal predicted observation and nominal predicted world map computed for three days shall be given to the following:

1. Network Controller
2. Ground Operations Manager

Copies of the World Map and Satellite Acquisition Data (WMSAD) shall be given to the TIROS Technical Control Center as required.

## 8.2 POST-LAUNCH OPERATIONS.

### 8.2.1 Theory and Analysis Office (T&AO).

The T&AO determines the orbit and attitude of the spacecraft on the launch day and as required thereafter. In addition, the T&AO has the following areas of responsibility.

8.2.1.1 Preparing the WMSAD predictions for WALACQ, NICOLA, ULASKA, SNTAGO, and RCAHNJ.

8.2.1.2 Preparing the Predictive Attitude World Map (ATMAP) which provides the spacecraft location and attitude.

8.2.1.3 Preparing the Satellite Conflicts (SATCON) runs for the TTCC.

8.2.1.4 Producing Attitude Predictions (MGAP) for long and short periods incorporating magnetic, gravitational, and eddy current torque effects.

8.2.1.5 Computing the APT daily and weekly messages.

8.2.1.6 Computing the spacecraft attitude from sensor and picture data.

8.2.1.7 Computing the definitive ATMAP and MGAP.

8.2.2 Operational Computing Branch.

8.2.2.1 Orbit Determination Section.

The Orbit Determination Section is responsible for using all the available tracking data to determine the TIROS orbit. When the orbit is computed, predictions as required are produced on magnetic tape.

8.2.2.2 Minitrack Section.

The Minitrack Section has the following responsibilities.

8.2.2.2.1 Receiving and preparing tracking data for orbit determination.

8.2.2.2.2 Receiving and placing on magnetic tape the spacecraft horizon sensor, picture and provisional attitude data.

8.2.2.2.3 Prepares WMSAD and MGAP data for transmission.

8.2.2.2.4 Determines the spacecraft spin rate from the sun sensor data.

8.2.2.2.5 Provides processing of selected portions of spacecraft telemetry.

8.2.2.3 Computer Services Section.

The Computer Services Section is responsible for the computer operating personnel and for the use of the necessary computing facilities.

8.2.3 Predictions.

Predictions as listed below are to be sent for the scientific lifetime of the spacecraft as follows:

| Station | Orbital Elements | Equator Crossings | Axes Crossings | WMSAD | APT Pred | ENV | ATMAP |
|---|---|---|---|---|---|---|---|
| Blossom Point, Md. | x | x | x | | | | |
| Ft. Myers, Fla. | x | x | x | | | | |
| Goldstone, Calif. | x | x | x | | | | |
| E. Grand Forks, Minn. | x | x | x | | | | |
| College, Alaska | x | x | x | | | | |

| Station | Orbital Elements | Equator Crossings | Axes Crossings | WMSAD | APT Pred | ENV | ATMAP |
|---|---|---|---|---|---|---|---|
| St. Johns, Newfoundland | x | x | x | | | | |
| Winkfield, England | x | x | x | | | | |
| Woomera, Australia | x | x | x | | | | |
| Santiago, Chile | x | x | x | | | | |
| Lima, Peru | x | x | x | | | | |
| Quito, Ecuador | x | x | x | | | | |
| Hartebeestock, S. Africa | x | x | x | | | | |
| Wallops Island, Va. | x | x | | x | | | x |
| San Nicolas Island, Calif. | x | x | | x | | | x |
| Fairbanks, Alaska | | | | x | | x | x |
| APT Stations | | | | | x | | x |
| SAOCAM | x | x | | | | | |
| SPADATS | x | x | | | | | |
| SPASUR | x | x | | | | | |
| SPATRK | x | x | | | | | |

A bound copy of the Predicted Observations and World Map is to be given to the Network Control Section of the Network Operations Branch.

Copies of the WMSAD and ATMAP as needed are to be given to the TIROS Technical Control Center for its use and dissemination.

DISTRIBUTION LIST

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